PROCEEDINGS

OF THE

ROYAL SOCIETY OF EDINBURGH.

1843. No. 22.

Monday, 6*th February* 1843.

Sir T. MAKDOUGALL BRISBANE, Bart., President, in the Chair.

The following communications were read :—

1. On the Law of Visible Position in Single and Binocular Vision, and on the representation of Solid Figures by the Union of dissimilar Plane Pictures on the Retina. By Sir David Brewster, K.H.,—*concluded.*

This subject is treated under eight different heads :—1. On the law of visible direction in *Monocular* vision. 2. On the law of visible direction in *Binocular* vision. 3. On vision of objects of three dimensions, by monocular vision ; by binocular vision. 4. On the binocular vision of figures of different magnitudes. 5. On the cause of the perception of objects in relief by the coalescence of dissimilar pictures. 6. On the doctrine of corresponding points. 7. On the vision of cameos and intaglios. 8. On the change in the apparent position of the drawings of solid bodies.

The general object of this paper is to establish the law of visible direction, (position in monocular vision,) and to shew that it is equally applicable to binocular vision, and affords a complete explanation of various phenomena which had been considered incompatible with it, but for which no theory had been proposed. In the last two sections, the author treats of the collateral subject of the vision of cameos, and of the drawings of solid bodies.

2. Papers on Glaciers. No. 1, Account of a Geometrical Survey of the Mer de Glace of Chamouni. By Professor Forbes.

This paper does not admit of abridgment. The author gave an account of a survey which he executed of the whole extent of the principal glacier of Mont Blanc and its tributaries. A base line of nearly 3000 feet was carefully measured in the valley, and extended by means of a very careful triangulation to a point on the glacier distant 28,600 feet, and elevated 4400 above the base line. From the several points of this triangulation, the positions and heights of the adjoining mountains were taken and laid down on a map on a scale of $\frac{1}{25000}$ of nature, portions having been drawn out to $\frac{1}{10000}$. The map was laid before the Society, and is now being engraved.

The following Donations of Books to the Society's Library were announced.

Elements of Chemistry, including the Applications of the Science to the Arts. By Professor Graham, University College, London. Part 6.—*By the Author.*

Maps of the Irish Ordnance Survey, containing the County of Waterford, in 42 sheets.—*By his Excellency the Lord Lieutenant.*

The following Donations to the Museum were presented—

Specimens of Volcanic Rocks from Vesuvius, and Minerals from Derbyshire.—*Presented by Sir T. M. Brisbane, Bart.*

Specimens of Fossil Shells from Grignon, collected by Dr Stark in Oct. 1833.—*Presented by John Stark, Esq.*

The following gentlemen were duly elected Ordinary Fellows of the Society:—

Dr John Rose Cormack, Fellow of the College of Physicians of Edinburgh.

Dr Allen Thomson, Professor of the Institutes of Medicine in the University of Edinburgh.

Monday, 20th February 1843.

The Right Honourable Lord GREENOCK, Vice-President, in the Chair.

The following communications were read :—

1. On the Anatomy of the Human Placenta. By John Goodsir, Esq., Conservator of the Museum of the Royal College of Surgeons of Edinburgh.

In the first section of the paper, the author described the parts which enter into the structure of the villi of the placenta. The villi are covered by a membrane with which anatomists are already familiar. Within this membrane, and attached to its internal surface, is a layer of cells, which has also been observed, and described as epithelium. The cells composing this layer, Mr Goodsir denominated the external cells of the villus. The next structure is a membrane not hitherto described, and named by the author the internal membrane of the villus. The adhesion of this membrane to the external cells is so slight, that it is generally seen at some distance from them, even in villi which have undergone no violence. Within the internal membrane of the villus, a set of very transparent cells, hitherto undescribed, is situated. These the author denominated the internal cells of the villus. The ultimate loops of the umbilical capillaries are imbedded in this mass of cells, the cells and vessels being closely bound up by the internal membrane of the villus.

The second section of the paper was devoted to the description of the fœtal portion of the organ. Mr Goodsir described the development and structure of the tufts of the chorion. He stated that the development consists in the addition of cells to the extremity of each villus of the tuft, these being supplied by a germinating mass, which resembles the spongiole of the root-fibre of a plant. These tufts and villi are entirely cellular, and are covered by a fine membrane. Before the villi become vascular, the ovum derives nourishment from the decidua, by the absorbing agency of the cells of the spongioles at the extremities of the villi of its chorion. When bloodvessels have formed in the villi, the cells, although less numerous, still remain, and are believed by Mr Goodsir to be the active absorbing agents in the villi of the placenta. In the perfect placenta, the villi of the chorion appear as the internal membrane, and the internal cells described in the first part of the paper. These, along with the umbilical vessels, constitute the fœtal portion of the placenta.

In the third section of the paper, in which Mr Goodsir treated of the maternal portion of the organ, he corroborated the statements of of Professors Weber and Sharpey as to the nature and structure of the decidua; and he more particularly described an interfollicular tissue, consisting of cells, which conduces, he thinks, as much as the enlargement of the glands, to the thickening of the mucous membrane. Since the discovery made by Professors Weber and Sharpey, too little attention, he believed, has been directed to the secretions of the thickened mucous membrane. This secretion, which forms the greater part of the decidua reflexa, is, according to the author, composed entirely of cells, and is the nourishment destined for the embryo, being taken up after solution by the absorbent cells of the villi. By tracing the cavities of the vessels of the gravid uterus from without inwards, as had formerly been done by Professor Owen, the author verified the statements of certain anatomists, that the vessels pass from the uterus into the decidua, and open on the internal surface of the latter by oblique valvular orifices. He likewise observed, that the meshes enclosed by the uterine veins become smaller and more ribbon-shaped near the cavity of the placenta, and that in that cavity they represent the appearance of hollow threads, which pass in great numbers from the uterine surface of the organ on to the extremities and sides of the villi, and also from villus to villus. Along the cavities of these threads the cellular mass of the decidua becomes continuous with the external cells of the villi.

From these observations, Mr Goodsir concluded that the sac of the placenta is a network of enlarged decidual vessels, the meshes of which have been reduced to hollow threads; and, secondly, that not only is the external membrane of the villi a part of the mother, being a portion of the membrane of her vascular system, but that the external cells also are maternal, being decidual cells continuous, along the hollow threads, with the general mass of the decidua.

Mr Goodsir stated in conclusion—

1. That the external membrane and the external cells of the villi constitute together the central division of the placental decidua, or the principal maternal portion of the organ, the cells being secreting cells destined to separate from the blood of the mother a matter proper for the nourishment of the fœtus.

2. That the villi present, in addition, an internal membrane and internal cells, which together constituted, at an earlier period, the villi of the non vascular chorion; that the internal cells are absorb-

ing cells, like the chyle cells of the intestinal tube, taking up for the fœtus the matter secreted by the external cells.

3. That the placenta not only performs the function of a lung, but also that of a gastro-intestinal mucous membrane.

2. On the Mode in which Sound is produced and diffused, and on the Vibrations caused in the quality of Sound by substance and form. By Sir George S. Mackenzie, Bart.

The following Donations of Books to the Society's Library were announced.

Voyage dans la Russie Méridionale et la Crimée, par M. Anatole de Demidoff. Tome 4, avec un Atlas des Planches.—*By the Author.*

Bulletin de la Société Géologique de France, from 15th March to 9th September 1841.—*By the Society.*

Proceedings of the Glasgow Philosophical Society, 1841-42.—*By the Society.*

The following Gentlemen were duly elected Ordinary Fellows of the Society:—Joseph Mitchell, Esq., civil engineer; Duncan Davidson, Esq. of Tulloch.

Monday, 27*th February* 1843.

Dr ABERCROMBIE, Vice-President, in the Chair.

The following communication was read.

Papers on Glaciers. No. 2, describing the Rate of Motion of the Ice of the Mer de Glace, deduced from observation. By Professor Forbes.

The author detailed in this paper the methods of observation by which he was enabled to ascertain the *daily* and even *hourly* motion of different parts of the glacier.

The following are some of the principal results:—

I. In the particular case of the Mer de Glace, the motion of the higher parts of the glacier are on the whole slower than those of its lower portion, but the motion of the middle region is slower than either.

The following table, the result of observations at a series of ascending stations, will authorize this conclusion.

	Velocity.
Lower part,........................	1.000 0.770
Middle do.,..........................	0.479
Higher do.,..........................	0.674

II. The Glacier du Géant moves faster that the Glacier de Lechaud in the proportion of 7 to 6.

III. The centre of the glacier moves faster than the sides. When two glaciers unite, they act as a single one in this respect, just as two united rivers would do.

The author measured the velocities at different places in the breadth of the glacier, and it was found to increase towards the centre. The following are the numerical results, assuming the motion of the ice near the edge as the standard or the unit of reference.

Side.			Centre.
1.000	1.332	1.356	1.367

IV. The difference of motion of the centre and sides of the glacier varies (1) with the season of the year, and (2) at different parts of the length of the glacier.

1. From the observations made, the author concludes, that "the variation of velocity diminished as the season advanced; and that it was proportional to the absolute velocity of the glacier at the same time."

2. The variation of the velocity with the breadth of the glacier is least considerable in the higher parts of the glacier, or near its origin.

V. The motion of the glacier generally varies with the season of the year and the state of the thermometer.

Perhaps the most critical consideration of any for the various theories of glacier motion is the influence of external temperature upon the velocity. It is shewn in this paper, by a direct numerical comparison, and by projected curves, that in nearly every instance the velocity of the glacier, during any period of days, has a reference to the temperature of the same period. If the thermometer fell, the glacier advanced slower, and *vice versa*. It is not, however, to be inferred that at the same external temperature the velocity will always be the same; only at any season, the change will always be in the same *direction*, and governed by the thermometer, though not always the same in amount.

The author also deduced from various indirect considerations, that it is very improbable that the glacier *stands still* in winter. On the contrary, he supposes that though its velocity is less than in summer, it still bears a considerable proportion to it.

Monday, 6th March, 1843.

The Right Honourable Lord GREENOCK, Vice-President, in the Chair.

The following communications were read :—

1. On the Nature, Locality, and Optical Phenomena of Muscæ Volitantes. By Sir D. Brewster, K.H.

2. On the Structure of the Lymphatic Glands. By John Goodsir, Esq., Conservator of the Museum of the Royal College of Surgeons of Edinburgh.

The author stated that the different lymphatics, as they enter the gland, become deprived of their external tunic, which passes on to the surface of the organ, to assist in forming its capsule. The middle tunic also becomes weaker, and presents the appearance of fibres arranged in the form of arches, which enclose rounded or oval spaces, particularly towards the surface of the gland, and at the angles formed by the anastomosis of one lymphatic with another. Mr Goodsir then observed that it was to the changes which the internal tunic of the lymphatics undergoes in the interior of the gland, that these organs owe their peculiar structure. This tunic, when traced from the afferent or efferent vessels into the gland, is found to become thicker and more opaque, till at length it no longer transmits light. It consists of two parts—a fine external membrane, and a granular substance attached to the inner surface of that membrane. The membrane belongs, according to the author, to the class of germinal membranes, with the germinal spots placed at regular distances. This germinal or primitive membrane of the internal tunic of the intra-glandular lymphatics is extremely delicate, and has germinal spots of an oval form, with compound nuclei. These spots are the sources of the nucleated particles which come from the granular substance. These particles are about the 4000th to the 5000th of an inch in diameter, and form a considerable proportion of the corpuscles, which have been long recognised in the fluid which may be squeezed out of lymphatic glands. The layer which these nucleated particles forms on the internal surface of the germinal membrane is so thick as almost to fill the cavity of the lymphatic. The canal of the vessel is irregularly pierced through the granular substance, the surface and particles of which are freely bathed by the chyle or lymph. This granular layer being continuous in both directions with the scale-like epithelium of the extra-glandular lymphatics, it is therefore merely a developed form of this epithelium.

Mr Goodsir then stated that the opinion of those anatomists who hold that the intra-glandular lymphatics form a net-work, is correct. In the glands in which the meshes of this net-work are elongated, the vessels, even after forcible injection, never assume the cellular appearance. In those glands again, or in those parts of glands in which the meshes are rounded or equilateral, the injection of mercury produces the appearance of globular cells. In other lymphatic glands, a process of absorption, similar to that which occurs in the maternal vascular system of the human placenta, reduces the meshes of the lymphatic net-work to mere threads or bars, and converts one or more short lymphatic branches into one multilocular cavity. All these varieties are modifications of the simple net-work.

The ultimate capillaries of the blood-vessels form very fine net-works on the external surface of the germinal membrane of the intra-glandular lymphatics. The anatomical relations of this capillary net-work, and the germinal membrane and granular substance of these lymphatics, are identical with those of the vessels, membrane and secreting epithelia of true glands.

One of the functions of the granular substance, the author stated to be the secretion of chyle and lymph corpuscles; but, as these are also formed in other parts of the lymphatic system, he reserved his observations on this part of the subject for a future occasion. He concluded by observing, that the structure he had described afforded, in his opinion, satisfactory evidence, 1st, That the lymphatic glands are merely net-works of lymphatic vessels, deprived of all their tunics but the internal, the epithelium of which is highly developed for the performance of particular functions; and, 2d, That these peculiar lymphatics have a fine net-work of capillary blood-vessels in close contiguity with their external surfaces, for the purpose of affording matter for the continued renovation of the epithelium.

3. On the Determination of Heights by the Temperature of Boiling Water. By Professor Forbes.

The investigations in this paper were made in order to reduce certain observations on the boiling point of water, made by the author in the Alps, in 1842.

He considered that it has been too generally assumed that the boiling point corresponds to a barometric pressure which expresses the elasticity of steam taken from the usual tables. He, therefore, attempted to deduce the connection of these data by a direct comparison of cases, in which both the barometer and boiling point were noticed by himself. He finds this result, that the pressures increase *rigorously* in a geometrical ratio, whilst the temperature of the boiling point rises uniformly. This law is not new, for Deluc arrived at the same result; but it appears to have been considered by all late writers as unworthy of adoption, and the scale of the elasticities of vapour by Dalton or Ure has been preferred. Now, these elasticities cannot, it is well known, be accurately represented by a geometrical proportion to the temperature; but Professor Forbes finds that the geometrical ratio represents the barometric heights exactly, whilst the tabular elasticities do not. But, farther, since the common barometric formula shews that the pressure varies geometrically, whilst the height above the sea varies uniformly, we have the same form of relation between the boiling point and the barometric pressure as between the height above the sea and the barometric pressure, namely, that each is as the logarithm of the other. Hence the boiling point falls *exactly* in proportion to the height ascended, and at the rate of 549.5 feet for 1° Fahr.

The following Donations of Books to the Society's Library were announced.

Monthly Notices of the Astronomical Society of London, containing Abstracts of Papers and Reports of the Proceedings of the Society. Vols. 1, 2, 3, 4, and vol. 5. Nos. 1–27.

Memoirs of the Royal Astronomical Society. Vol. XIV.—*By the Society.*

Examination Papers of the several Faculties in the University of London, for 1842.—*By the Council of the University.*

Mémoire sur la Chaleur des Gas Permanens, par Jean Plana, Astronome Royal, et Directeur de l'Observatoire de Turin.—*By the Author.*

Journal of the Asiatic Society of Bengal. Nos. 124 and 125, for 1842.—*By the Society.*

The Quarterly Journal of Agriculture, and the Prize Essays and Transactions of the Highland and Agricultural Society of Scotland. No. 60, for March 1843.

The following Donation to the Museum was presented—

A Specimen of a Vegetable Impression from Burdie House.—*Presented by D. Balfour, Esq. younger of Trenaby.*

The following Gentlemen were duly admitted Ordinary Fellows of the Society:—

Andrew Coventry, Esq., Advocate.
D. Balfour, Esq. younger of Trenaby.

Monday, 20*th March* 1843.

Sir DAVID BREWSTER, Vice-President, in the Chair.

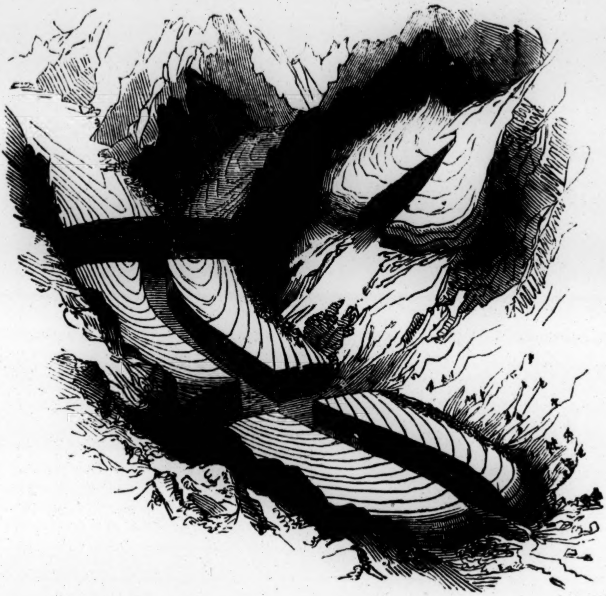
The following communication was read:—

Papers on Glaciers. No. 3, On the Structure of Glaciers, and the cause of their motion. By Professor Forbes.

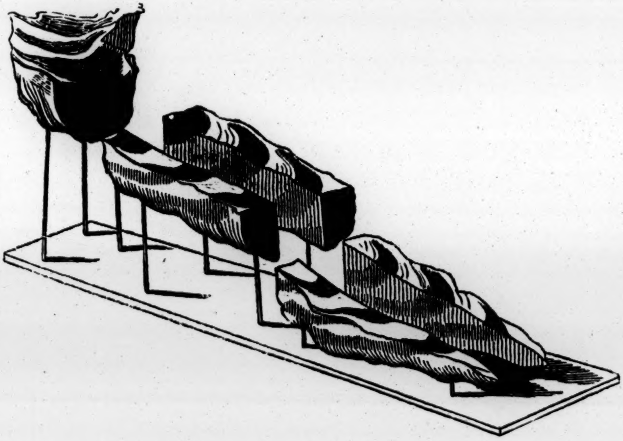
With reference to his former paper of the 27th February, the author stated, that he had received a most satisfactory confirmation of his opinion respecting the motion of glaciers in winter. From observations made by his direction on the Mer de Glace of Chamouni, and in which he places entire confidence, it appears that the ice moved no less than 76 feet between the 12th December 1842 and 17th February 1843, or at the rate of 13½ inches *per diem*, whilst its mean motion during the summer was 17½ inches.

The author then explained the manner in which he conceives the conoidal structure of glaciers to be due to the varying velocity of different points of their section producing discontinuity by minute fissures, which are infiltrated and ultimately frozen. He had before satisfied himself that the forms of these surfaces are such as the motion of the particles of a viscid fluid, obstructed by the sides and bottom of the canal in which it moves, would engender. But to make this more palpable, he has endeavoured to imitate the motion of a glacier, by causing a plastic fluid of different colours to mould itself by the action of gravity in an inclined bed, and he has thus succeeded in reproducing the forms of the structural surfaces of glaciers so precisely that they cannot be distinguished from the curves which he had drawn as representing the actual phenomena.—*See Edinburgh Philosophical Journal*, Oct. 1842, pages 346, 347.

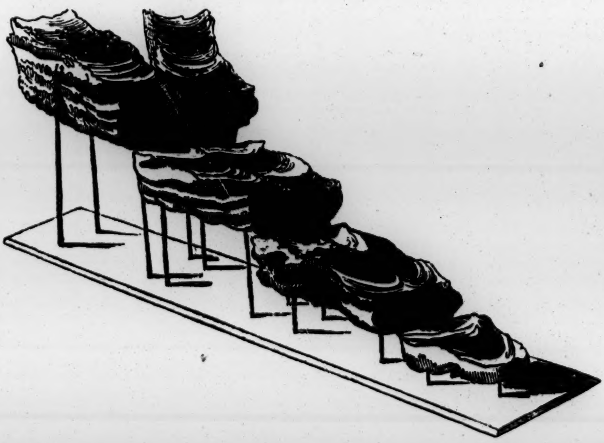
ILLUSTRATIONS OF THE VEINED STRUCTURE OF GLACIERS.



View of a Glacier, shewing its Structure by Ideal Sections.



View of a Model shewing the curves generated (experimentally) by the motion of a viscous fluid.



View of a Model shewing the effect of the union of two streams on the motion of a viscid fluid.

Professor Forbes also mentioned the objection recently taken by M. Agassiz to this theory of the veined structure being due to the different velocity of parallel portions of the ice, namely, that where two glacier streamers unite, their structure remains separate and distinct. Professor Forbes admits that it does so for a certain distance after union, but affirms, that, if the glacier be long enough, the structure always tends to consist of a single series of curves. He shewed, by models formed by the union of two plastic streams, that, in point of fact, such phenomena of united streams may be reproduced, the double structure being very slowly worn out, in consequence of the nearly uniform movement of the middle part of the stream.

Professor Forbes recapitulated the proofs that the glacier moves as a plastic mass, the friction of whose parts is less than their friction upon the surface over which they tend to slide ; and he bases his theory upon three classes of facts, which he considers that he has demonstrated. 1. That the glacier moves like a stream, fastest at the centre. 2. That its velocity is immediately governed by the external temperature and the state of infiltration of the ice by water at the time. 3. That the forms which its veined structure assumes are those due to the movement of a semi-solid mass in the manner supposed.

The following Donations of Books to the Society's Library were announced.

Archives du Museum d'Histoire Naturelle, publiées par les Professeurs-Administrateurs de cet Etablissement. Tome ii. Liv. 3.—*By the Editors.*

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences. Tome xv. Nos. 9-26, et Tome xvi. Nos. 1-7. —*By the Academy.*

Monthly Notices of the Astronomical Society of London. Vol. v. No. 28.—*By the Society.*

Specimen de l'Imprimerie de Bachelier, Rue de Jardinet.—*By M. Bachelier.*

Henry Stephens, Esq. was duly elected an Ordinary Fellow of the Society.

Monday, 27th March 1843.

Dr ABERCROMBIE, Vice-President, in the Chair.

The following communications were read:—

1. Observations on the Temperature and Hygrometric state of the Island of Barbadoes. By R. Lawson, Esq., Assistant-Surgeon of H. M. 47th Regiment. Communicated by Henry Marshall, Esq.

This paper contains an account of the Thermometric and Hygrometric observations made at the Barbadoes, from May 1841 to January 1842. The instruments were carefully verified and observed; and, during three months, the temperature was ascertained for 18 hours out of the 24. The author thence deduces the form of the daily curve of temperature for that period.

2. On the Growth and Migration of the Sea-Trout (Salmo Trutta). By Mr John Shaw, Drumlanrig. Communicated by James Wilson, Esq.

The author has here pursued the same course of experimental enquiry regarding the sea-trout, as that formerly followed in relation to the salmon. Having obtained impregnated ova, from a pair of spawning fish, he conveyed these ova to his experimental ponds. This was on 1st November 1839, and the young were excluded from the egg in 75 days. They resembled salmon of the same age, but were somewhat smaller and paler. They took two years to grow about seven inches, and the majority were then converted into smolts. But about one-fourth did not assume the silvery lustre; and this peculiarity, Mr Shaw thinks, distinguishes a like proportion even in the rivers. He then experimented on the smolts in the natural streams, and found, that, after descending to the sea, they returned as *herlings* (*Salmo albus* of Dr Fleming) in July and August, with an addition to their weight of seven or eight ounces. These herlings spawn towards the end of the season of their first ascent; and, after revisiting the sea, they ascend the rivers again in the ensuing months of May and June, with an average weight of 2½ lb. This increase takes place almost entirely in the sea. After spawning for the second time, they descend for the third time to the sea, and make their appearance again in fresh water in the course of the ensuing summer, weighing 4 lbs. They are now in their fifth year, including the two seasons they had passed as fry, anterior to the assumption of the migratory dress and instinct. Descending seawards for the fourth time, they weigh about 6 lbs., when next seen in the rivers, in the course of their sixth summer. These at least were the progressive changes and ratio of increase observed by Mr Shaw, in specimens distinctively marked, and carefully noted, when retaken in the river Nith successively from year to year. The peculiar marks imposed each season are detailed in his paper, and the whole subject is illustrated by an extensive series of specimens, from the day of hatching, to the middle of the sixth year. These specimens are now in the Society's Museum.

3. Experiments with Hydro- and Thermo-Electric Currents; and an Examination of Metals long exposed to Thermo-Electric Currents. By R. Adie, Esq. Communicated by Dr Traill.

The author commences his paper with a description of two forms of Electric Batteries, which he used in his experiments, and which consisted of bars of antimony and bismuth. One of these, which was chiefly intended for currents excited by solar and astral influences, was so delicate as to make the needle of the galvanometer deflect at right angles, when one end of the battery was exposed to the influence of clear summer's sun; and he therefore considers it a very delicate meteorological instrument. The other form of battery was principally used for thermo-electric currents, from a low flame of gas, or a spirit-lamp.

With the former instrument he succeeded in decomposing cyanide of silver, by exposure to the air for three months in winter, even although the voltameter, in connection with the battery, was often exposed to frost.

In using the second form of instrument, he remarked, that water is decomposed by copper poles, but not by poles of platinum,—a fact, which appears to him to account for Professor Daniell not having been able to produce electrolysis by primary thermo-currents. He farther observed, that metallic salts yield readily to a thermo-current, when the poles consist of the metal whose oxide forms the base of the salt.

On examining the effect of long-continued electrolysis on the metals constituting the battery, he found that no appreciable change was caused in the antimony by a current maintained for four months, and strong enough to cause, in 164 days, the deposition of a quantity of copper in the voltameter, equal to the weight of the battery. But the junctures of the bismuth and antimony, which were soldered by pure bismuth, presented an important change, even in thirty or forty days,—the bismuth soldering having undergone a species of disintegration, so that the antimonial bar was easily separated, and the surface of the bismuth lost its crystalline appearance, and might be rubbed off in the form of a fine powder. The author proved, that this change could not be the effect merely of the heat to which the metals were exposed, but is truly an electric phenomenon. Changes were also found to be effected, by long-continued electric currents, in the specific gravity of the metals. Antimony had its density raised, after exposure for twenty-two days to a thermo-electric current, from 6.645 to 6.670; and the density of bismuth was diminished from 9.853 to 9.838.

In pursuing his experiments with hydro-currents, he found, that the elimination of hydrogen from a copper wire soon comes to an end under the influence of pressure caused by the accumulation of gas in a hermetically sealed space around the wire, while the deposition of copper goes on. By hydro-currents, aided by pressure, he obtained leaf-like deposits of metal, in solutions of common salt, with poles of copper, tin, silver, and zinc, and pulverulent deposits with gold, mercury, antimony, cobalt, platinum, and arsenic. But when iron, bismuth, cadmium, and nickel were used, no deposition took place,—the hydrogen continuing to be disengaged, till the voltameter burst.

To these investigations the author added some experiments on the effects of quick and slow cooling, in altering the densities of metals. He found, that antimony loses in density by sudden cooling; that this metal, and also bismuth, do not gain in density by slow cooling; that by this process the density of lead, tin, and zinc is increased; that copper and silver are densest when allowed to cool slowly; that iron undergoes no change by slow cooling, unless first heated very strongly, in which case its density is diminished; and that steel loses in density by the process of hardening, but does not lose by repeated heating.

Lastly, in conformity with the experiments of Bequerel, on the developement of electric currents, by sudden alterations in the density of metals, the author found, that, when the density of gold, platinum, cadmium, silver, and iron, was increased, by passing them through the drawing-plate, a deflection of from one to four degrees was occasioned in the galvanometer: but with lead and tin no perceptible deflection was occasioned.

The following Donations of Books to the Society's Library were announced.

Bulletin des Séances de la Société Vaudoise des Sciences Naturelles. Nos. 1 & 4.—*By the Society.*

Essai Historique sur les Phénomènes et les Doctrines de l'Electro-Chimie. Par Elie Francois Wartmann.—*By the Author.*

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences. Tome XVI. Nos. 8 & 9.—*By the Society.*

On the Transparency of the Atmosphere and the Law of Extinction of the Solar Rays in passing through it. By James D. Forbes, F.R.S. &c.—*By the Author.*

The following Donations to the Museum were presented—

Specimens of the Hyperstene Rocks of the Cullin Hills, and of the Limestone and Dykes traversing the Cullen Hills at Kilbride, Isle of Skye. Collected by G. Bellas Greenough, Esq.—*Presented by Lord Greenock.*

Specimens of the Calcareous Formation of the Bermudas and Bahama Islands. Collected by Lieut.-Colonel Emmett, R.E.—*Presented by Lord Greenock.*

Monday, 3d *April* 1843.

Sir T. MAKDOUGALL BRISBANE, Bart., President, in the Chair.

The following communications were read:—

1. Chemical Observations on the Flowers of the Camellia Japonica, Magnolia Grandiflora, and Chrysanthemum Leucanthemum, and on three Proximate Principles which they contain.—*Conclusion.* By Dr Hope.

The author first called the attention of the meeting to the principal facts which he had established in the two memoirs read to the Society in the year 1836. 1*st*, Of these the most important are, that when acids cause a red colour, and alkalis a green or yellow, in a blue vegetable infusion, they act on different substances:—the acids on erythrogen, and the alkalis on xanthogen. *2dly*, That the compound of alkalis and xanthogen is of a yellow colour, and that when a blue infusion is changed to green, it is owing to the gradual intermixture of the newly generated yellow with the original blue.

Camellia Japonica.—The blossoms of the beautiful double white Camellia Japonica are remarkable for the peculiar matters which they contain, two of which appear to be distinct vegetable principles. When a parcel of the petals is infused in boiling-hot water, and digested for some time, a nearly colourless infusion is obtained, which is not visibly affected by acids. When solution of potash is added, a light orange colour appears, which gradually deepens, till in a few hours it acquires a very deep orange hue. Solution of ammonia causes a similar effect. When lime-water is employed, it produces turbidity in the infusion, and a pinkish red colour. This colour gradually assumes a richer tint, and in about 24 hours exhibits a deep pinkish red. The author has applied the same alkalescent agents to above 150 flowers, both white and coloured, without observing any similar effect.

To this colourable matter he gives the name of Camelline. The author tried the effects of various reagents, but no interesting facts resulted.

When any portion of the flower-leaf is bruised, whether remaining on the parent plant or removed from it, it immediately begins to assume a rusty or ochry tint, which grows deeper and deeper, till it arrives at the tint of perfect ochre.

By various experiments, it was proved that this change of colour depends upon the action of the oxygen of the air. It takes place in a very remarkable degree in oxygen gas, and does not take place at all when the contact of air is excluded by an immersion in mercury, in hydrogen, or carbonic acid gas. To this brown-growing matter, viewing it as a distinct vegetable principle, Dr Hope gave the name of Magnoline, in consequence of its occurring in a very remarkable degree in the Magnolia grandiflora and Magnolia conspicua. A third remarkable circumstance respecting the Camellia petals, is, that they contain a notable quantity of iron. This was little to be expected, seeing that iron is so common a source of colour, and the blossom is entirely colourless. The author was led to search for this metal in consequence of the strong resemblance which the colour which protoxide and protocarbonate of iron acquire by the absorption of oxygen from the air, and the colour acquired by the bruised petals of the Camellia bear to each other. Dr Hope is satisfied that the ochry tints of the Camellia are in no way dependent on, or connected with, the iron which it contains.

Magnolia Grandiflora. — When the petals of the *Magnolia Grandiflora* are boiled for some time in distilled water, a liquor of a very light yellowish brown is obtained. This colour is banished by sulphuric acid. Solution of potassa immediately causes a deep gallstone yellow, shewing that this, like other white flowers, contains no erythrogen, but abounds in xanthogen. That matter, which becomes of an ochry hue by the contact of air, is very abundant in the Magnolia, so that, if the cuticle be scraped off, in less than a minute the place of abrasion exhibits the ochry tint. The petals of the snow-white *Magnolia conspicua* exhibit the same phenomena in a still more remarkable degree. If a petal of this beautiful flower be bruised between the fingers and thumb it immediately becomes of a very deep brown, and ere long almost black. Some other white flowers, by being crushed and exposed to the air, also acquire the ochry tint, but in a much inferior degree to those already mentioned. The ochry-growing matter is not confined to white flowers. It exists in different species of the blue flowers of the Aconitum, particularly the napellus.

The third flower of which Dr Hope gave an account, was the *Chrysanthemum leucanthemum*, the ox-eye daisy. A strong decoction of the white petals exhibits a light brown colour, which potash quickly converts into the usual gallstone yellow. When sulphuric acid is dropped into this decoction, the colour becomes a light primrose yellow, and the liquid immediately assumes a gelatinous state. This jelly gradually becomes more consistent, and, in about a quarter of an hour, it is so firm that the capsule containing it may be inverted without the jelly falling out. The matter thus gelatinized by sulphuric acid is peculiar to this plant. The author has applied sulphuric acid to the infusion of at least 150 flowers, without any similar result taking place. The author conceives that the gelatinising matter is a distinct vegetable principle, to which he gave the name of Leucanthemine. To support this view, he drew a comparison between it and the coagulable matters both of the animal and vegetable kingdoms, viz. animal albumen, casein, fibrin, and vegetable albumen. In drawing this comparison, the author described some remarkable properties of these albuminous matters, which have escaped the observation of all the investigators of the chemistry of organic substances, and some of which he had been in the habit of exhibiting in his lectures for nearly half a century. These are, principally, that sulphuric acid dissolves the albuminous matters in the cold, and yields a nearly colourless solution, without altering the nature of the albumen. But if the liquor be heated to 160°, it acquires an extremely beautiful rich crimson hue, during which change the nature of the albumen is totally altered. Muriatic acid acts upon albuminous matter nearly in the same manner; but the colour which the solution acquires by being heated is a very rich purple. The jelly from the Leucanthemum affords no crimson colour with sulphuric acid. After pointing out other circumstances of difference, the author gave his opinion that the Leucanthemine ought to be considered as a distinct substance *sui generis*, another vegetable principle; and concluded with expressing his hope that the Camellia, Magnolia, and Chrysanthemum furnish three to the long list of vegetable proximate principles.

2. On certain Negative Actions of Light. By Professor Moser of Kœnigsberg. In a Letter to Sir David Brewster.

"There are certain actions of light which may be called *negative actions*. By this name I mean to indicate a series of *new actions*, without pretending to enter into any theoretical considerations. In acting upon an iodised plate, common light produces successively different states, which are made manifest by exposing the plate, when taken out of the camera, to the vapours of mercury. If the plate has remained in the camera but a short time, we shall see only the first traces of an image. The parts most strongly affected by the light condense the mercurial vapour only in small quantities. If the light acts during a longer time, the image will appear with more details and more distinctly, the mercurial vapours being condensed more abundantly. By increasing the time of action, the image gains in details, but the parts which have been affected with a strong light condense the mercurial vapours in smaller quantities. The images that exhibit many details have usually at the same time a grey aspect, arising from the mercurial vapours having already begun to blacken the iodised silver. If the plate remains still longer in the camera, it does not present any visible image; but when exposed to the mercurial vapours, there is produced an image wholly *negative*. The parts which have been too long acted upon by an intense light condense little vapour, and hence become completely *black*, while the parts which were in shadow condense much vapour, and appear *white*. Hence arises the peculiar aspect of the image. When this period of action is exceeded, the plate comes out of the camera with a visible image, which the vapours of mercury scarcely affect. This species of images is well known to experimentalists, and they have not hitherto been applied to any useful purpose.

" Now, when any one of the above *states* of the image has taken place, we may always, and easily, cause the image to retrograde on the plate, and arrest it at any anterior state we please. For example, I leave the iodised plate 300 minutes and more in the camera, whereas 10 minutes are sufficient to produce an ordinary Daguerreotype picture. When this plate is withdrawn from the camera, it presents a distinct negative image. I then expose the plate during 22 seconds to the vapours of *iodine*, and then to those of *mercury*, and the result of this is the production of a splendid Daguerreotype picture. The vapour of the iodine has, therefore, caused the action of the light to *retrograde*. I have repeated and varied these experiments in every way, and always with the same success, taking care not to allow the vapours of iodine to act too long, otherwise they would completely destroy the action of the light.

" There are many other bodies which, in their gaseous state, produce the same negative actions, when applied to an iodised plate, such as *chlorine*, *bromine*, the *hydro-fluoric acid*, &c. &c. ; but I shal not enlarge on this point, because I have to mention to you a gas much more interesting, viz. *oxygen*, which exercises the same negative action.

" Having left the iodised plate from *four* to *six* times the period necessary for an ordinary picture in the camera, and exposed it to *pure oxygen* during a few seconds, the mercurial vapours produce the ordinary image. The oxygen in atmospheric air acts also upon the plate, and requires only that the action be prolonged. If we expose a plate with an image that would become *negative* by mercurial vapour, during *one* or *two* minutes, to a current of air from a pair of bellows that would raise a column of water *four* or *five* inches high, the image will be presently brought back to its ordinary state ; or if the blast is continued longer, to any other anterior state, the primordial state not excepted. Atmospheric air, indeed, quite calm, exercises also these negative actions, provided its action is continued for some hours.

" I may also add, that among the gases which compose atmospheric air, oxygen alone produces these negative effects. Nitrogen, carbonic acid, and the vapour of water, do not produce them ; the latter, however, produces the effects which I have described in my Memoir on the Latent State of Light. These negative actions are never produced by any of the rays of solar light.

"It appears to me that these new facts, of which I have communicated to you the most remarkable, lead to important results. It naturally follows from them, that the oxygen of the atmosphere will retard the action of light, and tend to preserve the surfaces of bodies in their primordial condition. I have, without success, endeavoured to make a direct experiment on this subject. I placed a camera-obscura under the receiver of an air-pump, and exhausted the air; the time, however, for producing any particular effect of light did not change; but the air-pump was so imperfect, that it did not produce a rarefaction beyond five or six inches of the barometer. In the mean time, however, I may adduce some of my experiments communicated seven months ago to the Academy of Sciences at Berlin, which prove, at least indirectly, what the air-pump has not yet verified. If we wet an iodised plate of silver with *any fat oil*, we shall find that the time in which light produces any particular effect is greatly diminished. In applying, for example, *oil of olives*, the plate will be four or five times more sensitive; so that, instead of four or five minutes, *one* minute only will be necessary to produce the same effect in the camera. The mercurial vapour readily penetrates the thin film of oil, and produces very perfect images. This singular action of oils arises probably from their obstructing, or, at least, enfeebling, the negative action of oxygen gas. The mercurial vapours produce even a better developed image, that is to say, one which corresponds to a more prolonged action of light, if we apply the oil only at the instant the plate is taken out of the camera.

"I believe that these negative actions, which bring back the surfaces of bodies to their natural state, will throw some light upon the process of vision, because the same effects seem to take place upon the retina. But I greatly regret that I am not able to enter into any details on this interesting subject, as I am wholly occupied with other researches, particularly on a very remarkable and different kind of action exerted by *hydrogen gas*."

3. On the Specific Gravity of certain Substances commonly considered lighter than Water. By Dr Davy.

The author enters on the subject by adverting to the apparent lightness imparted to the common woods, and to certain vesicular minerals, by the entanglement of air in their substance, as is commonly understood, and as is proved by the action of the air-pump.

The specific gravity of oak-wood, after having been kept under the exhausted receiver till it sunk in water, and ceased to give off air, he found to be (inclusive of hygrometric moisture) 1.58 ; that of deal, 1.18, or when crushed about 1.5 ; that of the pith of the elder, 1.45 ; and that of pumice, 1.94, or crushed, 2.41, which is nearly the same as that of obsidian, from which pumice appears to be formed by the action of volcanic fire.

Reasoning analogically, the question naturally occurred, are there not other substances, commonly considered lighter than water, which are so only in appearance, owing, it may be, to air adhering to their surface, or included in them, such as cork, caoutchouc, camphor, wax, spermaceti, cholesterine, stearine ?

Cork, he finds, continues to float on water, after having been kept under the exhausted receiver nearly two months. This he attributes to the elasticity of the plates constituting its cells, confining a very minute quantity of air, that cannot be extracted by the pump. When the cells are broken, it sinks in water. From indirect experiments, he infers its specific gravity to be about 1.6, or nearly the same as that of lignin.

In common caoutchouc, he detected the presence of air by the microscope, which, owing to the peculiar quality of this substance, could not be separated either by the air-pump, or by compression, or by boiling. Dissolved in ether, and precipitated by alcohol, he found it apparently of specific gravity .97 ; allowing for circumstances interfering with accuracy of result, he conjectures that the specific gravity of caoutchouc is about the same as that of water.

The specific gravity of camphor, he concludes from his experiments, to exceed a very little that of water, viz. as 1.005 to 1.000 ; that of bees' wax, and also that of spermaceti and of stearine, to be about the same as that of water at the temperature 50°, though considerably lighter at the boiling temperature of water ; and that of cholesterine to be a little higher, viz. 1.0102.

In conclusion, he expresses the opinion, that attention to the specific gravities of the substances under consideration, may be useful in conducting chemical analyses of compound bodies in which they may be contained ; that a consideration of the cause of their apparent lightness, viz. included or adhering air, may help to explain some rather obscure phenomena,—as the raising of cream, &c. ; and that attention may be deserving of being paid to the same cause, as exemplified in the substances treated of, whenever, in works of art, unusual lightness or buoyancy is a desideratum.

The following Donations to the Society's Library were announced.

Scheikundige Onderzoekingen, gedaan in het Laboratorium der Utrechtsche Hoogeschool. St. 5.—*By the Author.*
Natuurkundige Verhandelingen van de Hollandsche Maatschappij der Wettenschappen te Haarlem. Deel. 2.—*By the Society.*

The following Donations to the Museum were presented—

Series of Specimens of the different Rock Formations. (150 specimens.)—*Presented by Lord Greenock.*
Specimens connected with Mr Shaw's paper on the Development and Growth of the Sea-Trout of the Solway.—*Presented by Mr John Shaw.*

Monday, 17*th April* 1843.

The Right Honourable Lord GREENOCK, Vice-President, in the Chair.

The following Communications were read :—

1. On the presence of Organic Matter in the purest Waters from Terrestrial Sources. By Professor Connell.

It must be well known to chemists, that when solution of acetate of lead is added to the transparent and colourless water of springs, wells, and rivers, a more or less dense white cloud is almost invariably produced. This reaction has been usually attributed to the presence of inorganic salts, such as carbonates, sulphates, and muriates ; but it will be found that, generally speaking, this precipitate is formed even after the water has been boiled ; that it is usually dissolved by the speedy addition of a drop or two either of acetic or of nitric acid, without visible effervescence ; and that the agency of the water with nitrate of silver is commonly too small to admit of its being caused by any muriate. These facts exclude the idea that it is due in the general case to carbonates, sulphates, phosphates, or muriates ; although, of course, in those particular cases where the water has enough of such constituents to affect acetate of lead, the reactions will be modified accordingly. Thus, in some cases, where the first action is as above stated, a deposition takes place after a certain interval of sulphate of lead, no longer soluble in weak acids.

It occurred to the author that the true cause of the reaction was to be found in the presence of organic matter in the water, derived from the decomposition of vegetable matter in the strata or soil through which it had passed. To ascertain whether this view was correct, the precipitate by acetate of lead from several quarts of the town water of St Andrews was decomposed by sulphuretted hydrogen. After filtration, a liquid was obtained, which, besides sulphuric acid derived from precipitated sulphate of lead, was found to contain some organic matter apparently of an azotised nature; but its amount was too small to characterise its properties with accuracy. The salt obtained by saturating the liquid with potash, yielded by distillation empyreumatic vapour, and left a black coaly mass behind. The liquid itself, when neutralized and sufficiently diluted, had still a marked action on lead salts; and it or its potash salt produced more or less precipitate after the interval of a day or two, in acetate of copper and neutralized persulphate of iron.

The author has found this matter in the town waters of Edinburgh and Glasgow, but to a less extent than in that of St Andrews. The Glasgow water shewed the least of the three. He has also found it more or less in every instance he has hitherto tried of transparent and colourless well, spring, or river water. In rain water it does not exist, and probably could not be found in springs above the limits of vegetation, or in snow or glacier water. It would seem that it ought to perform functions of some importance in the economy of nature, as contributing in a certain degree to the nourishment of plants and even of animals.

2. Biographical Sketch of the late Sir Charles Bell. By Sir John MacNeill.

This paper is, from its nature, incapable of being here given in an abridged form.

3. Notice regarding the Bebeeru Tree of British Guiana. By Dr A. Douglas Maclagan.

The plant bearing the above Indian name, and also called Sipeeri by the Dutch colonists, furnishes the hard and heavy timber known by the name of Greenheart. The object of the present paper was to state the result of experiments made by the author on the bark and seeds of the tree, which had been found by Mr Rodie, R. N., to contain a vegetable alkali possessed of the power of checking intermittent fevers. Dr Maclagan stated that the tree was unknown to botanists. Sir William Hooker and Dr Lindley had seen the fruit and declared it to be lauraceous, but the author had been unable to find, in Rees v. Esenbeck's *Systema Laurinarum*, any genus or even suborder of lauraceous plants to which he could refer it. With regard to its chemical qualities, Dr M. stated that he had obtained both from the bark and seeds two distinct alkalis, both uncrystallizable, to one of which he applied Mr Rodie's name, Bebeerine; to the other he gave the name of Sipeerine. They could be separated by anhydrous ether, the bebeerine being soluble in that menstruum, whilst the sipeerine was not. Dr M. had likewise obtained, especially from the seeds, a peculiar crystallizable and deliquescent acid, which he called Bebeeric acid, and which seemed to be distinct from every vegetable acid hitherto described.

The author stated that he had instituted experiments with a view to ascertain if a soluble salt of the alkalis could be procured, which might be used as a substitute for sulphate of quinine when dear. He stated, as the result of his trials, that the produce did not amount to more than one and a-half of sulphate per cent. from the bark, but he still calculated that if the bark could be got at a moderate price, the salt of the alkalis might be prepared at a cost inferior to that of sulphate of quinine. Dr Maclagan stated that the bark appeared to be better suited for the purposes of manufacture than the seeds. The author mentioned that sulphate prepared under his directions had been sent out to Demerara, and had been tried there with marked success in intermittent fever by Dr Watt; he had likewise used it with success in a few cases of ague in Edinburgh, and also in periodic headache, so that he had no doubt of its possessing considerable power as an antiperiodic remedy. Lastly, he mentioned that a secret preparation sold under the name of "Warburg's Fever Drops," reputed a good antiperiodic, appeared to him to be a tincture of bebeeru seeds.

W. H. Norie, Esq., was duly elected an Ordinary Fellow of the Society.

The following Donations for the Society's Library were announced.

The Quarterly Journal of Meteorology and Physical Science. Edited by J. W. G. Gutch, M. R. C. S. No. 6. for April 1843.—*By the Editor.*

Proceedings of the London Electrical Society. Part 8.—*By the Society.*

Annual Report of the Council of the Yorkshire Philosophical Society, for 1842.—*By the Society.*

Elements of Agricultural Chemistry. By Sir Humphrey Davy, Bart. (Sixth Edition.)—*By Dr John Davy.*

Proceedings of the Royal Astronomical Society. Vol. V. No. 29. —*By the Society.*

Proceedings of the Royal Society. Nos. 55 & 56.

Revised Instructions for the use of the Magnetic and Meteorological Observatories, and for the Magnetic Surveys. Prepared by the Committee of Physics and Meteorology of the Royal Society.—*By the Royal Society.*

Monday, 1*st May* 1843.

Sir T. M. BRISBANE, Bart., President, in the Chair.

The following Communications were read :—

1. An attempt to explain the Phenomena of the Freezing Cavern at Orenburg. By Dr Hope.

Dr Hope in the first place read, from the Proceedings of the Geological Society in London, the account of the freezing cavern furnished by the President of the Geological Society of London. This is one of several caves which exist in the southern face of a lengthened low hillock of gypsum. It is entered from the south by a passage rather narrow, and is about fifteen feet high, ten paces long, and seven wide, which seemed to send off irregular fissures into the body of the rock.

The extraordinary feature of this cavern is, that during summer it is so cold that ice is generated in it, and dry icicles hang from its roof; and that, in winter, all appearance of congelation ceases, and the temperature becomes such that the Russians say they could sleep in it without their sheep-skins.

Mr Murchison applied to Sir John Herschel for an explanation, and the theory which he proposed is, that the heat and cold of the surface gradually move, though very slowly, backward into the rock;

that it requires six months for the wave of cold, as he terms it, to reach the cavern, and consequently, that that frigid wave begins to arrive at the commencement of summer, and continues during that season, occasioning such a degree of cold in the cavern as to produce the congelations described by Mr Murchison.

At the commencement of winter, the first effect of the summer's heat arrives, and continues without interruption, and occasions warmth enough to prevent congelation.

Dr Hope entirely concurred with Sir John Herschel in thinking that alternate waves of heat and cold must exist and have a share in producing the phenomena, and in corroboration quoted the observations of Saussure, that at Geneva the winter's cold requires six months to descend 29½ feet, and that the summer's heat penetrates to the same depth in a similar period of time; the maximum of cold taking place at mid-summer, and of heat at mid-winter.

But he also expressed his conviction that these alternate waves were not sufficient to account for the phenomena, further remarking, that were they the only powers employed, the paradoxical phenomena should occur equally in some of the other caverns of the Orenburg hillock, or in other caverns in different quarters of the globe. He observed, that there must be something peculiar to the Illetykaya Zatchita cavern which renders it the only cave in the world which possesses the singular property, so far as he knew. He then alluded to the caverns in different parts of the globe in which accumulations of snow are found in summer, and concurred with Mr Murchison in thinking that they have no analogy with that of Orenburg. They are merely receptacles of the winter snow and ice, and preserve it during summer, after the manner of an ice-house.

The circumstance peculiar to the Orenburg cave is the occurrence of the rents and fissures which rise from the back part of the cavern.

The author stated, that if it were granted that these fissures reach the surface, even by the smallest ramifications, and that they ascend within the reach of the alternate waves of heat and cold, the whole phenomena may be easily and satisfactorily explained. He ascribed the summer's coldness and congelation to a constant current of cold air through the fissures of the rock into the cavern; and he supposed that the current is occasioned in the following manner: When at the close of spring the temperature of the external air and of that in the rents is the same, no particular occurrence takes place; but as soon as the wave of cold begins to make impression on the rocky parietes of the fissures, then the air in them will be somewhat cooled, contracted, and rendered specifically heavier. This being so, the weight of the column of air in these rents will be greater than that of a column of equal altitude of the external atmospheric air, and the consequence will necessarily be, that the colder air will descend, the warmer atmospheric air from above will supply its place, which, in its turn, will be cooled and descend, and thus a current of cold air through the crevices into and through the cavern will be established. As the temperature of the rocky parietes gradually falls with each successive wave of cold, the air in the fissures will become colder and colder, and in the same proportion will descend more rapidly.

But the rapidity of descent does not only depend upon the increasing coldness of the air in the fissures, but is further augmented by the warmth of the summer expanding the external air, so that the difference of weight between the external and internal columns becomes greater. In the manner now explained, a current of cold air is constantly descending and flowing through the cavern, producing all the surprising frigorific effects displayed within it.

That such a current does exist, Mr Murchison gives a satisfactory proof; he says, " That upon unlocking the frail door of the cavern, a volume of air, so surpassingly keen, struck the legs and the feet, that he was glad to rush into a cold bath in front of him to equalize the effect." This downward current will continue the same till the close of autumn, when its course comes to be changed; by that time the first approaches of May's surface warmth will begin to be experienced, the cold of the sides of the rents begins to diminish, and the temperature of the external air must have fallen to nearly that of the internal current. As soon as an equality between the temperatures and densities of the external and internal columns shall have been established, all current must cease. At this period, namely, the commencement of winter, the wave of the summer's heat begins to reach both the walls of the air-channels and of the cavern, and gradually communicates a warmth which progressively elevates the temperature, and dissipates every mark of the preceding summer's congelation. It might at first be reasonably expected, that at this time the preceding order of things would be reversed, and that a current in the opposite direction would commence, such as, it is known, happens in many mines; for, undoubtedly, the temperature of the atmosphere descending rapidly, the gravity of the external air would soon exceed that of the internal column. A current would immediately commence from below, and, entering from the cavern door and ascending through the rents, escape at the surface. The consequence of such a current would be, that the cold would soon reappear in the cave, and gradually increase during the severity of the winter, and completely overpower the heating influence of the thermal wave, now beginning to operate on the walls of the cavern, and so prevent the warmth of the cave during winter.

An occurrence, however, now takes place which puts a stop to the upward draught, and permits the thermal wave to have its full influence on the temperature of the cavern. The winter commences with repeated falls of snow, which form a thick covering on the surface of the earth, and closes up all the communications between the extremities of the crevices and the external air, and no current can take place. In this manner the influx of the intensely cold air into the cavern, and its ascent through the fissures, is prevented, and then full play is given to the calorific power of the wave of heat which continues to arrive in the cavern through its rocky sides during the whole continuance of winter, and communicates the warmth recorded by Mr Murchison. In the beginning of summer the snows melt, and the terminations and ramifications of the fissures have their communication with the atmosphere restored. The currents, as already described, are re-established, and all the paradoxical phenomena to which they give birth present themselves in due succession.

2. Observations on the Temperature of the Earth in India. By John Caldecott, Esq. Communicated in a Letter to Professor Forbes.

These thermometers, made by Mr Adie of Edinburgh, were sunk in the ground at Trevandrum, in lat. 8° 30′ 35″, to depths of 3, 6, and 12 *French* feet. Mr Caldecott says,—" I send you herewith the readings of my long thermometers, which, from various causes, I was not able to put into the ground until the 1st of last May (1842). These two months' readings, therefore, will not, of course, have the proper temperature at the respective depths, especially as it has been raining more or less nearly ever since. Still, I think they will surprise you, as being (so far as they go) entirely opposed to Kupffer's opinion, that the superficial temperature of the earth within the tropics is *below* that of the air, and to Boussingault's assertion, as to the invariability of the temperature *one foot* below the surface. The soil in which the thermometers are buried, is one which very soon becomes compact again, after having been disturbed, so that I do not think the rain can much affect the thermometers *now* * * * * . The situation is on the top of the Observatory hill; the soil, the stone called Laterite."

A subsequent letter contains the readings for four entire months, and confirms the important conclusions mentioned above. The mean annual temperature of the air at Trevandrum is 79°.24 F.

1842.	12 Feet.	6 Feet.	3 Feet.	Air.
May	84.672	85.157	83.820	80.09
June	...	84.562	82.062	79.32
July	84.805	83.627	81.025	78.73
August	84.240	82.800	80.220	77.90

The surface of the ground was grass-grown, and the thermometer stems quite exposed.

3. Researches in Hydrodynamics. Second Memoir. On Waves. By J. Scott Russell, Esq., M.A., F.R.S.Ed., &c.

The object proposed by the author of this paper, was to present, in a complete form, the results of investigations into the phenomena of Waves, in which he had been engaged for several years. A part of the experiments referred to in the paper, had been carried on by Sir John Robison, conjointly with the author of this paper, as a Committee of the British Association. The others were new, and had been carried on by himself, for the purpose of completing and giving that systematic form to our knowledge of the subject, which was attempted in this paper.

The author finds that there may exist in agitated water waves different in kind, generated by different causes, propagated by different laws, and exhibiting different phenomena. These had not hitherto been sufficiently distinguished, and some of them were scarcely known. The following table exhibits the classification resulting from these investigations :—

Waves are of four Orders.

	ORDER I. The Wave of Translation.	ORDER II. Oscillating Waves.	ORDER III. Capillary Waves.	ORDER IV. Corpuscular Waves.
CHARACTERS.	Solitary.	Gregarious.	Gregarious.	Solitary.
SPECIES.	Positive. Negative.	Stationary. Progressive.	Stationary. Progressive.	
VARIETIES.	Free. Forced.	Free. Forced.	Free. Forced.	
INSTANCES.	The Primary Wave of Resistance. The Tide-Wave.	The Secondary Wave of Resistance. River Ripple. Wind Waves.	Dentate Waves. Zephyral Waves.	Wave of Sound through Water.

The rest of the paper consisted of the examination of the properties, and an explanation of the phenomena, of these four orders of waves.

The following Books, presented to the Library of the Royal Society of Edinburgh, were laid on the table—

Transactions of the Geological Society. (Second Series.) Vol. VI. Part 2.—*By the Society.*

Archives du Muséum d'Histoire Naturelle, publiées par les Professeurs-Administrateurs de cet Etablissement. Tome iii. Livr^{ns} 1, 2.—*By the Editors.*

The following Donations to the Museum were announced—

A Head of Boodhoo in Dolomite from Ceylon.—*By Dr Davy.*

Specimens of Coal from Penteraclea, the Ancient Heraclea, on the Black Sea.—*By the Same.*

Specimen of "Burn Trout." *Salmo Fario,* taken from the Compensation Pond, weighing 6 lb.—*By James Miller, Esq.*

A Specimen of Chalcedony, from Iceland.—*By Sir G. S. Mackenzie.*

Six Specimens shewing the Action of Glaciers on Rocks:—

1. Limestone taken from under the Ice of the Glacier of La Brenva in Piedemont, in July 1842.
2. 3. 4. Specimens of Granite from the Grimsel, supposed to shew Glacier Polish.
5. 6. Specimens of Limestone from the Jura, shewing (supposed) Glacier Polish.—*By Professor Forbes.*

Specimens of Fossil Fish, from the Old Red Sandstone of Morayshire, named by M. Agassiz.—*By Prof. Forbes.*